

City of Oceanside Loma Alta Ultraviolet Light Treatment Facility Final Report

State Water Resources Control Board
Grant Agreement 06-315-550

Acknowledgements

Guss Pennell Project Director City of Oceanside

Consultants

Orion Construction Corp. Construction
Carollo Engineering Design

Prepared by:
Mark Hammond City of Oceanside (760) 435-5948

March 16, 2010

Table of Contents

Section Number	Description	Page
1.0	Project Summary	3
1.1	Introduction	3
1.2.	Background	3
1.3	Project Objective	4
1.4	Project Scope	4
1.5	Project Description	5
2.0	Project Funding	6
3.0	Monitoring	7
4.0	Results	8
5.0	Conclusion	8

Appendices

I	Indicator Bacteria Monitoring Data	9
II	Submittals	17

Figures

Figure 1	Photo taken from Buccaneer Beach looking north	3
Figure 2	Photo of Loma Alta Creek about 1 mile east of the beach	4
Figure 3	UV treatment facility building	5
Figure 4	UV facility creek intake structure	6
Figure 5	Treated water discharge point on Buccaneer Beach	6
Figure 6	Aerial photo of discharge point and surf zone sample locations	7
Figure 9	Bacteria removal efficiency chart	8

Tables

Table 1	SWRCB Water-Contact Standards	7
Table 2	Creek Intake Structure Indicator Bacteria Results	9
Table 3	UV Influent Indicator Bacteria Results	10
Table 4	UV Effluent Indicator Bacteria Results	11
Table 5	Surf Zone Enterococcus Bacteria Results	12
Table 6	Surf Zone Total Coliform Bacteria Results	13
Table 7	Surf Zone Fecal Coliform Bacteria Results	14
Table 8	Enterococcus Bacteria Removal Efficiency	15
Table 9	Total Coliform Bacteria Removal Efficiency	16
Table 10	Fecal Coliform Bacteria Removal Efficiency	16

1.0 PROJECT SUMMARY

1.1 Introduction

Buccaneer Beach is a popular beach located in Oceanside. This is a family beach adjacent to a park with a large parking area that sees large crowds during the dry summer months. One of the features of the beach is that Loma Alta Creek flows across the beach year-round.



Figure 1 Buccaneer Beach looking north with Loma Alta Creek flowing across the beach.

1.2 Background

Loma Alta Creek drains approximately 6,400 acres and includes densely developed residential, commercial, and industrial areas. The flow from the creek has contributed to water quality degradation at the Buccaneer Beach for years. Numerous beach closures due to elevated bacterial levels have been attributed to discharge from Loma Alta Creek.

The Loma Alta Creek watershed is included on Section 303(d) of the federal Clean Water Act list of impaired water bodies for bacterial indicators and eutrophication within the lagoon and for 1.1 miles of coastline. The increased presence of bacteria and pathogens in the watershed poses a threat to REC-1 and REC-2 beneficial uses and directly impacts the ocean water quality at Buccaneer Beach.

The City began taking measures in 1992 to prevent beach closures at Buccaneer Beach during the summer months. The mouth of the creek was closed with a temporary sand barrier and the creek flow was diverted to the adjacent La Salina Wastewater Treatment Facility. The creek flow was not treated but was combined with treated wastewater and pumped one and a half miles offshore through the ocean outfall pipe. While this solution has allowed the City to reduce the number of closures at Buccaneer Beach, the Regional Board indicated to the City that this



Figure 2 Loma Alta Creek east of I-5

was a temporary solution to the problem and they would like the City to develop an alternative method. In addition, the creek flow volumes threaten to impact the proper treatment and disposal of wastewater, due to increasing populations and the limited capacity of the wastewater treatment facility and associated ocean outfall.

The Loma Alta Creek UV Treatment Facility was completed in August 2008. After testing, operator training and minor modifications to the facility, the treated lagoon water was discharged onto the beach for the first time on September 15, 2008. The facility continued to run until the end of September 2008. At that time, the facility was taken off line for the rest of the winter and spring. The facility was restarted at the beginning of June 2009 and ran through to the end of September 2009.

1.3 Project Objective

Eliminate beach closures at Buccaneer Beach during the dry weather months due to high levels of bacteria from Loma Alta Creek.

1.4 Project Scope

Dry weather flows from Loma Alta Creek will be diverted through a treatment facility that includes screening, filtration and ultraviolet light disinfection. The Treatment Facility is designed to inactivate bacteria prior to discharge on Buccaneer Beach. The Facility will operate only during dry weather periods, as it does not have the capacity to treat wet weather flows.

1.5 Project Description

The project involved the construction of a filtration and ultraviolet (UV) light treatment facility located adjacent to the Loma Alta Creek outlet at the existing City of Oceanside's La Salina Wastewater Treatment Facility. During the dry weather months the mouth of the Creek is



Figure 3 UV Treatment Facility

closed with a sand barrier and one hundred percent of the dry weather creek flows (averaging 300 to 700 gallons per minute) are intercepted in the lagoon and diverted to the UV treatment facility, located on the northern bank of the creek. After treatment the creek water is discharged across the beach into the ocean.

The treatment facility consists of a creek intake structure, two large sand filters followed by two UV disinfection units housed in a reinforced concrete building. The treated water is discharged through a pipe that extends along the existing section of rip-rap that runs along the north side of the Loma Alta creek outlet at Buccaneer Beach. During wet weather months (November through April), the lagoon mouth is opened to allow Loma Alta Creek to flow to the ocean and the UV system is bypassed.

With this approach the entire dry weather flow of Loma Alta Creek is treated to meet water contact bacteria standards before it is returned to the beach. This eliminates beach closures at Buccaneer Beach due to bacterial contamination from Loma Alta Creek during the summer months.



Figure 4 Creek Intake Structure



Figure 5 Treated water discharge point

2.0 PROJECT FUNDING

Funding for the project was provided by the State Water Resources Control Board, Clean Beaches Grant Program, and came from Proposition 40, the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002. A Grant agreement for the construction of a Filtration and Ultra Violet Light Radiation Facility was made between the State of California and the City of Oceanside. The term of the agreement began on April 21, 2005 and ended on February 28, 2010. There were no match funds or non-grant funds used for this project.

Project funding has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views

and policies of the State Water Resources Control Board, nor does mention of trade names of commercial products constitute endorsement of recommendation for use.

3.0 MONITORING

In order to monitor the effectiveness of the UV Facility to meet the project objective, the City monitored indicator bacteria concentrations on a weekly basis at the facility influent, effluent and three points in the beach surf zone. This data is found in Appendix I.

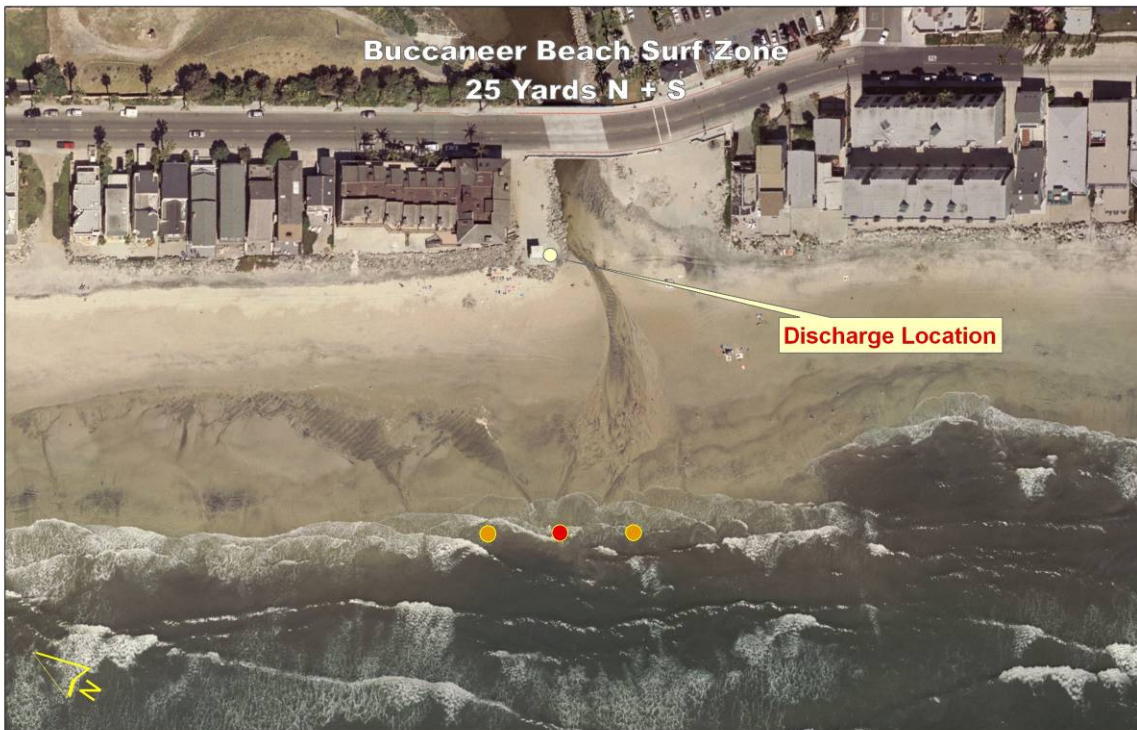


Figure 6 Surf zone sample locations

The treatment objectives for the facility are the REC-1 Water-Contact Standards as set forth in the California Ocean Plan by the State Water Resource Control Board (SWRCB). The treatment objectives are listed in Table 1.

Table 1 SWRCB Water-Contact Standards

INDICATOR ORGANISM	30 day Geometric Mean Density per 100ml	Single Sample Maximum Density per 100ml
Total Coliform	1000	10000
Fecal Coliform	200	400
Enterococcus	35	104

4.0 RESULTS

Bacteria removal efficiencies through the UV Facility were calculated at 99% based on the intake and effluent samples taken during the first full dry season that the system was in operation (Tables 8, 9 & 10). The results for Total Coliform, Fecal Coliform, and Enterococcus bacteria were well below the Water Quality Objectives for all UV facility effluent samples taken during June through September 2009. Additionally, all surf zone sample results were well below Water Contact Standards during this period.

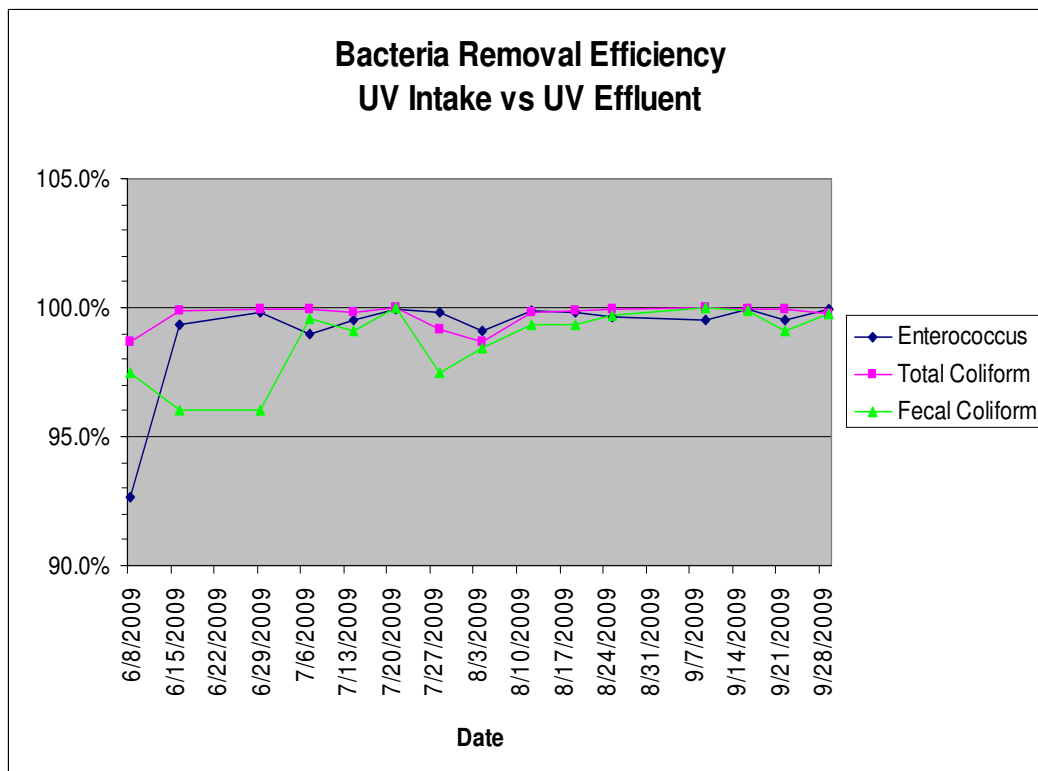


Figure 7 Bacteria Removal Efficiency

5.0 CONCLUSION

The UV Facility was instrumental in reducing the indicator bacteria concentrations in the Loma Alta Creek flow that was discharged to the beach. All Rec-1 water standards were met at the beach. There were no beach closings during the time the UV facility was in operation.

Appendix I

Indicator Bacteria Monitoring Data

Monitoring Program

The monitoring program consisted of weekly grab samples collected during the periods that the UV facility was operating. The samples were tested for indicator bacteria (Total Coliform, Fecal Coliform and Enterococcus) and were collected from the UV facility and the beach surf zone. The UV facility samples were collected at the intake structure, UV reactor influent and UV reactor effluent. The surf zone samples were collected at the UV effluent/ocean mixing zone and 75' north and 75' south of the mixing zone. T

Bacteria Monitoring Results

Intake Structure – raw untreated water from Loma Alta Creek.

The results from the intake structure samples show high levels of indicator bacteria in the raw untreated creek water. Seventeen of the eighteen samples exceeded the single sample maximum standard for water contact (table 1).

Table 2 Creek Intake Structure Indicator Bacteria Results

Collection Date	Enterococcus MPN/100ml	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml
9/16/2008	36.4	3000	30
9/22/2008	236	3000	140
9/29/2008	>2420	>16000	>16000
6/8/2009	687	1700	80
6/16/2009	148	1700	50
6/21/2009	Scratched	Scratched	Scratched
6/29/2009	2420	2400	50
7/7/2009	2420	5000	500
7/14/2009	649	1100	220
7/21/2009	>2420	>16000	>16000
7/28/2009	>2420	1300	80
8/4/2009	>2420	300	130
8/12/2009	>2420	1100	300
8/19/2009	1990	1700	300
8/25/2009	>2420	5000	700
9/9/2009	>200	>16000	>16000
9/16/2009	>2420	5000	1700
9/22/2009	>200	5000	220
9/29/2009	1410	3000	800

Scratched – not tested due to lab/sampling error

UV Influent – Loma Alta Creek Water post sand filter.

The UV Influent sample is representative of creek water after screening and filtration. These processes remove debris and suspended material prior to exposure to UV radiation. As expected there is no significant removal of bacteria after screening and filtration. Fifteen of the eighteen samples exceeded the single sample maximum standard for Water Contact (table 1).

Table 3 UV Influent Indicator Bacteria Results

Collection Date	Enterococcus MPN/100ml	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml
9/16/2008	3.1	500	4
9/22/2008	27.9	800	50
9/29/2008	>2420	>16000	9000
6/8/2009	38.9	30	4
6/16/2009	165	600	23
6/21/2009	Scratched	Scratched	Scratched
6/29/2009	214	1300	27
7/7/2009	1120	500	70
7/14/2009	128	500	110
7/21/2009	>2420	>16000	>16000
7/28/2009	1200	<20	<20
8/4/2009	345	230	20
8/12/2009	866	300	50
8/19/2009	152	130	80
8/25/2009	214	300	130
9/9/2009	2420	9000	5000
9/16/2009	172	9000	500
9/22/2009	>200	2800	130
9/29/2009	579	<20	<20

Scratched – not tested due to lab/sampling error

UV Effluent – Loma Alta Creek Water post UV treatment.

The UV Effluent sample is representative of creek water that has been fully treated by the Loma Alta Creek Ultraviolet Treatment Facility. Overall, the Facility demonstrated excellent removal of indicator bacteria. The samples taken during initial startup in September 2008 show some variability in bacteria removal and it is suspected that the cause of the high results on 9/22/08 and 9/29/08 are due to sampling or lab error. All sample results for the first full season of operation starting in June 2009 show significant reduction of indicator bacteria and are well below water contact standards (table 1).

Table 4 UV Effluent Indicator Bacteria Results

	Enterococcus MPN/100ml	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml
9/16/2008	<1	<2	<2
9/22/2008	1550	80	80
9/29/2008	98.7	2700	500
6/8/2009	50.5	23	<2
6/16/2009	1	<2	<2
6/29/2009	4	<2	<2
7/7/2009	24.1	<2	<2
7/14/2009	3	<2	<2
7/21/2009	2	<2	<2
7/28/2009	4.1	11	<2
8/4/2009	21.3	4	<2
8/12/2009	3	<2	<2
8/19/2009	4.1	<2	<2
8/25/2009	8.4	<2	<2
9/9/2009	1	<2	<2
9/16/2009	2	<2	<2
9/22/2009	<1	<2	<2
9/29/2009	<1	8	<2

Surf Zone – Enterococcus bacteria

The surf mixing zone was sampled every week at three locations (Figure 6) while the Facility was discharging to the beach. The samples were tested for three types of indicator bacteria, Total Coliform, Fecal Coliform and Enterococcus. All surf mix zone results for Enterococcus bacteria were below water contact standards (table 1).

Table 5 Surf Zone Enterococcus Bacteria MPN/100ml

Sample Date	SURF MIX ZONE	SURF MIX ZONE 75' North	SURF MIX ZONE 75' South
9/16/2008	< 10	< 10	< 10
9/22/2008	< 10	< 10	< 10
9/29/2008	< 10	< 10	< 10
6/8/2009	< 10	< 10	< 10
6/16/2009	< 10	< 10	< 10
6/29/2009	< 10	< 10	10
7/7/2009	< 10	< 10	< 10
7/14/2009	< 10	< 10	< 10
7/21/2009	< 10	< 10	< 10
7/28/2009	< 10	< 10	< 10
8/4/2009	< 10	< 10	< 10
8/12/2009	< 10	< 10	< 10
8/19/2009	< 10	< 10	< 10
8/24/2009	10	< 10	< 10
9/9/2009	31	< 10	< 10
9/16/2009	< 10	< 10	< 10
9/22/2009	< 10	20	< 10
9/29/2009	31	< 10	10

Surf Zone – Total Coliform bacteria

The surf mixing zone was sampled every week at three locations (Figure 6) while the Facility was discharging to the beach. The samples were tested for three types of indicator bacteria, Total Coliform, Fecal Coliform and Enterococcus. All surf zone results for Total Coliform bacteria were below water contact standards (table 1).

Table 6 Surf Zone Total Coliform Bacteria MPN/100ml

Sample Date	SURF MIX ZONE	SURF MIX ZONE 75' North	SURF MIX ZONE 75' South
9/16/2008	< 2	2	11
9/22/2008	2	< 2	< 2
9/29/2008	14	8	< 2
6/8/2009	2	2	4
6/16/2009	13	17	2
6/29/2009	< 2	2	2
7/7/2009	< 2	2	2
7/14/2009	2	50	2
7/21/2009	4	4	3
7/28/2009	< 2	< 2	< 2
8/4/2009	13	13	4
8/12/2009	4	< 2	2
8/19/2009	4	13	4
8/24/2009	< 2	< 2	2
9/9/2009	80	4	2
9/16/2009	4	7	2
9/22/2009	2	2	2
9/29/2009	30	30	70

Surf Zone – Fecal Coliform bacteria

The surf mixing zone was sampled every week at three locations (Figure 6) while the Facility was discharging to the beach. The samples were tested for three types of indicator bacteria, Total Coliform, Fecal Coliform and Enterococcus. All surf zone results for Fecal Coliform bacteria were below water contact standards (table 1).

Table 7 Surf Zone Total Coliform Bacteria MPN/100ml

Sample Date	SURF MIX ZONE	SURF MIX ZONE 75 'North	SURF MIX ZONE 75' South
9/16/2008	< 2	2	2
9/22/2008	< 2	< 2	< 2
9/29/2008	6	2	< 2
6/8/2009	< 2	< 2	< 2
6/16/2009	8	11	2
6/29/2009	< 2	< 2	2
7/7/2009	< 2	< 2	< 2
7/14/2009	< 2	9	< 2
7/21/2009	< 2	2	2
7/28/2009	< 2	< 2	< 2
8/4/2009	4	4	< 2
8/12/2009	2	< 2	2
8/19/2009	4	4	2
8/24/2009	< 2	< 2	< 2
9/9/2009	9	4	< 2
9/16/2009	< 2	< 2	< 2
9/22/2009	2	2	2
9/29/2009	11	8	52

UV Facility Bacteria Removal Efficiency

The following tables show the indicator bacteria removal efficiency of the UV treatment facility during the first full season of operation (June 2009 through September 2009). The Facility demonstrated a removal efficiency of 99% for indicator bacteria during this time period.

Table 8 Enterococcus Removal Efficiency

Enterococcus Removal MPN/100ml				
	UV Intake	UV Effluent	% Removal	
6/8/2009	687	50.5	92.6%	
6/16/2009	148	1	99.3%	
6/29/2009	2420	4	99.8%	
7/7/2009	2420	24.1	99.0%	
7/14/2009	649	3	99.5%	
7/21/2009	> 2420	2	99.9%	
7/28/2009	> 2420	4.1	99.8%	
8/4/2009	> 2420	21.3	99.1%	
8/12/2009	> 2420	3	99.9%	
8/19/2009	1990	4.1	99.8%	
8/25/2009	> 2420	8.4	99.7%	
9/9/2009	> 200	1	99.5%	
9/16/2009	> 2420	2	99.9%	
9/22/2009	> 200	< 1	99.5%	
9/29/2009	1410	< 1	99.9%	
Average			99.2%	

Table 9 Total Coliform Removal Efficiency

Total Coliform Removal MPN/100ml				
	UV Intake	UV Effluent	% Removal	
6/8/2009	1700	23	98.6%	
6/16/2009	1700	< 2	99.9%	
6/29/2009	2400	< 2	99.9%	
7/7/2009	5000	< 2	100.0%	
7/14/2009	1100	< 2	99.8%	
7/21/2009	> 16000	< 2	100.0%	
7/28/2009	1300	11	99.2%	
8/4/2009	300	4	98.7%	
8/12/2009	1100	< 2	99.8%	
8/19/2009	1700	< 2	99.9%	
8/25/2009	5000	< 2	100.0%	
9/9/2009	> 16000	< 2	100.0%	
9/16/2009	5000	< 2	100.0%	
9/22/2009	5000	< 2	100.0%	
9/29/2009	3000	8	99.7%	
Average			99.7%	

Table 10 Fecal Coliform Removal Efficiency

Fecal Coliform Removal MPN/100ml				
	UV Intake	UV Effluent	% Removal	
6/8/2009	80	< 2	97.5%	
6/16/2009	50	< 2	96.0%	
6/29/2009	50	< 2	96.0%	
7/7/2009	500	< 2	99.6%	
7/14/2009	220	< 2	99.1%	
7/21/2009	> 16000	< 2	100.0%	
7/28/2009	80	< 2	97.5%	
8/4/2009	130	< 2	98.5%	
8/12/2009	300	< 2	99.3%	
8/19/2009	300	< 2	99.3%	
8/25/2009	700	< 2	99.7%	
9/9/2009	> 16000	< 2	100.0%	
9/16/2009	1700	< 2	99.9%	
9/22/2009	220	< 2	99.1%	
9/29/2009	800	< 2	99.8%	
Average			98.7%	

Appendix II Submittals

Work Item	Items for Review #	% Of Work Complete	Date Submitted
EXHIBIT A	1.0 QUALITY ASSURANCE PROJECT PLAN AND MONITORING PLAN		
	1.1 Quality Assurance Project Plan	100%	5/30/2007
	1.2 Monitoring Plan	100%	5/30/2007
	2.0 WORK TO BE PERFORMED BY GRANTEE		
	2.1 Project Design	100%	7/19/2007
	2.1.2 As-Advertised Construction Documents	100%	7/19/2007
	2.1.4 Bid Summary, Proof of Advertising and Construction Notice to Proceed	100%	7/19/2007
	2.2 Project Implementation		
	2.2.2 Photo Documentation (Pre, During, and Post)	100%	12/10/2008
	3.0 REPORTING	70%	Ongoing
	3.1 Annual Progress Summary	33% 66% 100%	04/23/2008 09/16/2008 12/28/2009
	3.2 Draft Project Report	100%	2/22/2010
	3.3 Final Project Report	100%	3/16/2010
EXHIBIT B	5.0 REPORTS		
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	1 st - 0%	7/24/2007
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	2 nd – 25%	10/17/2007
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	3 rd - 50%	01/24/2008
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	4 th - 75%	04/23/2008
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	5 th - 95%	08/18/2008
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	6 th - 100%	12/10/2008
	5.1 Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter (March, June, September and December)	7 th - 100%	12/28/2009
	5.2 Grant Summary Form	100%	07/19/2007
	5.3 Natural Resources Projects Inventory Project Survey Form	100%	03/03/2010
EXHIBIT C	6 Copy of Final CEQA/NEPA Documentation	100%	07/19/2007
	22 Signed Cover Sheets For All Permits	100%	10/17/2007
EXHIBIT D	5 Monitoring and Reporting Plan	100%	05/30/2007